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REVIEWS AND ABSTRACTS OF LITERATURE

Darwinism and the Problems of Life. A Study of Familiar Animal Life. CONRAD GUENTHER. Translated from the third German edition by JOSEPH MCCABE. London: A. Owen & Co. 1906. Pp. xii + 424.

This volume that had reached its third edition in the original by 1905 is one that is certain to have a high degree of usefulness. It is planned by the author to present the 'range, foundation and value' of evolutionary theories, and in its appeal to the reading public it presupposes no special knowledge of science, beyond the observations of nature and the ideas that form part of the content of every intelligent and reflective mind. It appears about the same time as two other works that also deal with the fundamentals of evolutionary science, and with its scope as well, namely, the two-volume translation of the general lectures by August Weismann, and the first part of the 'Vorlesungen über Descendenztheorien' by Lotsy. The latter is to be a thorough presentation of the whole subject with special reference to botanical material, and appeals to the specialists in general biology solely; while Weismann's book, rendered available to a wider group by the excellent English translation, is addressed to university circles primarily, and is a complete statement of this author's most important contributions considered in their relation to the whole field of evolution.

Guenther is himself a Weismannian, in the essentials of his doctrine, but his work is far from approaching a parallel of Weismann's book. For not only in the lucidity of its presentation and discussion, but in its arrangement of the materials also, it is adapted above all others as a book that may be taken up by those who possess very little idea of science, and whose ignorance leads them to hold very erroneous ideas of the present state and value of evolutionary doctrine. It is, as it were, a beautifully written 'gospel to the unscientific,' who doubt, because they are not familiar with the present state of biological knowledge, that scientific generalizations may be of service as practical guides in thought and conduct.

Without formal division, the book falls into two parts. Nine of the twelve chapters deal serially with the several phyla or major divisions of animal organisms in inverse order from the mammals down to the unicellular creatures, while the remainder is devoted to a general discussion of the main principles of the doctrine and to their extension into the so-called 'higher' realms of thought. But this latter part still retains the lucidity and clearness that characterize the earlier portion, where the manner of conveying definite ideas to the reader is all the more remarkable in its success, as there are no pictorial illustrations in the book.

The first section does not call for detailed review or description. Throughout it all, the author uses the special group under discussion to illustrate some one or some few general principles. For example, in the course of the introductory chapter, where a most vivid word-picture of the complexity of animal relations is presented, an opportunity is found for the statement of the elements of the orthodox doctrine of natural selection, emphasis being put upon the interconnection of every organism with all other elements of its environment, be these inorganic or organic, like the individual itself or of unlike species. A most interesting view is given of human interrelations with all the creatures that with man make up a 'biocenosis,' or vital community. Again, in the second chapter, where the mammals are specifically treated, not only are the colors of animals considered as adaptive characteristics of their wearers, but the whole subject of mental evolution is outlined. The author's own statement here (p. 79) may be cited, in order to give some idea of his views upon this subject as well as of his method of presentation. "We now know that the theory of evolution need not stop short at man; that even **his** mind is no obstacle to our admitting his development from animal ancestors. The mind of man does not differ from that of other animals in kind but only in degree, and there is nothing to prevent us from supposing that it has been raised from the animal level by natural selection to its present altitude. Just as Copernicus smote the conceited belief out of humanity that their kingdom, the earth, was the center of the world, so Darwin has put an end to their assumption that they occupy an exceptional position on our planet. The earth is a stage of a part of the eternal, ever-changing world-mass; humanity is a phase of a part of the ever-advancing world of organic life."

Pursuing the same method, the author incidentally—one is tempted to say, insinuatingly—introduces the reader to great and wide subjects through a discussion of a concrete group of facts. Guenther takes up with the birds the subject of sexual selection, regarding which he is, of course, orthodox in the Darwinian sense; with reptiles, the nature of the paleontological evidence, and persistent types, and also regeneration as an adaptive characteristic, though here he disregards too completely, I think, the divergence in views brought out in the discussion between Weismann and Morgan; with fishes, the biogenetic law, namely, that individual development is a brief review of racial history; with insects, the Lamarckian principle of 'inheritance of acquired characters,' where he takes the extreme position of the thoroughgoing selectionist; crustacea and mollusca are used for the discussion of the chemistry of protoplasm and of metabolism; with worms and cœlenterates he discusses parasitism; and finally, in connection with the protozoa is given a very satisfactory statement of the fundamental cell theory, of the continuity of the germ-plasm as established by Weismann, of immortality as an original character of primitive organisms, and of the whole question as to origin of life and spontaneous generation.

But the reader will turn with greater interest to the later chapters that deal in a general way with the intrinsic nature and scope of the principles of evolution, for the elements of the subject with which the author has dealt earlier in an incidental way are, after all, biological and zoological truisms. The principal topic is, of course, the entire adequacy of natural selection as an explanation of evolutionary method, and this writer holds firmly to the conviction that it is. Sexual selection is regarded as a complement to natural selection, as by Darwin, and not as a subordinate form of the latter. Likewise, isolation is recognized as a 'factor' in the differentiation of species, in a sense operating independently of natural selection; it—isolation—may be only "a preparatory principle . . . which *makes possible* the formation of new species. This formation may be brought about by natural selection *after* the isolation" (p. 331). But Guenther believes that isolation alone may bring about this result, without the aid of natural selection, 'if there were some force in the organisms that caused variations to advance in some definite direction in the offspring' (p. 331). And such a 'force' (*absit nomen*) is found in germinal selection as brought forward by Weismann, according to which selection operating upon and among the several parts of an organism *produces* adaptive modifications or a correlated condition of adaptation, by an intraselective process. Orthogenesis, however, is regarded as a form of inheritance of acquired characters, and with the Lamarckian principle is thrown out bodily.

The point that merits much criticism, in the opinion of the reviewer, is the author's attitude toward the work of de Vries and others, on mutation or saltation as the method of evolution; for it is here assumed that mutation and selection are mutually exclusive processes, whereas many believe, as the evidence accumulates, that these processes are really supplementary. It is strange that an upholder of the germ-plasm theory should fail to see that the essential feature is the fixity or heritability of new or aberrant characters, and that a heritable variation or fluctuation of the Darwinian order to have a specific value should involve some chromosomal change, precisely as in the case of a mutation or sport, and that the latter differs from fluctuation only in its wider deviation from the parental type. Nor does the author seem to be aware that a mutation is not necessarily swamped by intercrossing, by 'amphimixis,' for in many of the recent experiments the new character takes precedence over its antecedent. It is strange, too, that absolutely no mention is made of the great body of results in the field of statistical study of selection and heredity, for even the works of Mendel and his followers receive no mention. In view of the vast importance of these experimental results, this is a serious omission.

With the mechanistic interpretation, as opposed to the vitalistic, nearly all will agree. While it is true that neo-vitalistic views of writers like Driesch have met with some acceptance, these are so attenuated and metaphysical that they suffer in contrast with the unified and self-consistent mechanical interpretation of the phenomena of life. The pragma-scientist (*verbum novum*) will also willingly accept the conclusion that evolutionary processes are not teleological, in the sense that an end attained controls the attainment of that end, and with this author will reject entirely 'final causes' as contrasted with 'efficient causes' for an evolutionary history.

It is difficult to follow Guenther farther, however, where he draws a sharp line between the material and the psychic, when he states that physical science in the wider sense and psychology are independent and need a new science to reconcile and unify them. It will be well to quote the last paragraph of the eleventh chapter (p. 389): ". . . It is consciousness that encloses in itself all existence, the material and the spiritual world, since both provinces can only be conceived as processes or states of consciousness. In consciousness we have a unity and a truly 'monistic' standpoint. But consciousness, the all-perceiving subject, can never become the object of an empirical science. When we wish to study it, we have to leave aside the scientific method and turn to philosophy. This is the last and highest science. It is the foundation on which every theory that aims at comprehending reality must rest. It is the undying merit of Immanuel Kant to have shown us the way to it." And yet some may be inclined to agree with the reviewer that consciousness itself can indeed be brought within the scope of scientific method and of evolutionary doctrine.

But above all else the analysis of the subjects taken up in the final chapter—'Nature History and Ethics'—demands earnest consideration. After showing that a descriptive account in biological terms may be given of the evolution of human history, social organizations and of ethical standards, the author immediately abandons all hope of unifying the worlds of 'fact' and of 'values.' He says (p. 425): "We have now reached the fundamental objection to all scientific ethics. Science regards cosmic processes merely as changes, and pays no attention to values. It abandons its methods entirely and contradicts itself when it begins to recognize values. Hence it can not have an ethics, because this has no meaning unless the moral laws that it sets up, and especially the life of man and the improvement of it, are regarded as having worth. Thus for science—to repeat our conclusion—there is no such thing as an aim, an end, or a value in the world."

Yes, in the sense that science can not ascertain the *final* causes and values of the universe—if it has any—because these do not exist in experience. What have we, as concrete individuals, living in a world of reality, to do with 'ultimates' and 'final values'? Can they be real for us? Do they mean anything at all for us? It would, of course, be a mistake to suppose that science has anything to say about that which does not exist in experience of one kind or another. But is it not equally erroneous to regard science as merely a record of events and their connections? Such a conception seems outworn by this time, when men do indeed derive practical guidance and values from their classified and unified experience—from scientific generalizations. These principles reflect us back again, in James's pregnant phrase, into the world of further experience, and they possess a worth and finality commensurate with the body of fact that they summarize, as so much 'conceptual shorthand.' Our author fails, then, to extend the scope of evolutionary method so as to include all phenomena, and many will approve his conservatism. It remains for the future to show whether the pragmatic method, that of science, can be extended to the confines of human speculation, or must fail in the fields of metaphysics and philosophy.

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The Integrative Action of the Nervous System. Comprising the Silliman Memorial Lectures delivered at Yale University, 1904. CHAS. S. SHERRINGTON. New York: Chas. Scribner's Sons. 1906. Pp. xvi + 411.

The aim of this book, as its title indicates, is to set forth in detail the manner in which the nervous system serves to bring together in united action the various parts of the animal organism. There are other agencies also which bring about integration of the organism, as, for example, the mechanical union of parts by connective tissue, the union through chemical action in digestion, or through transference of fluid, as in the circulation of the blood. The integration which is the function of the nervous system, however, is unique in that 'it works through living lines of stationary cells along which it dispatches waves of physicochemical disturbance, and these act as releasing forces in distant organs where they finally impinge' (p. 3). An important characteristic of this integration, moreover, is that it is an integration of *activities.* By means of the nervous system the organism is enabled to act as a unit toward ends which the action of every part subserves.

This functional unity of the entire organism is attained through the activity of the nervous system as a coordinative mechanism. This coordination, expressed in its simplest terms, is the production of an activity which is appropriate to a given stimulus. The unit of such coordination is the reflex act, and the corresponding nervous unit is the reflex arc. The first problem which the author attacks, then, is the determination of the characteristics of simple reflex action.

The significant characteristics of reflex action are brought into relief by a comparison of conduction in the reflex arc with conduction in the nerve trunk. It is in virtue of these characteristics that the reflex arc is fitted to be a coordinative mechanism.

The differences may be enumerated as follows: In reflex arcs as compared with nerve trunks there is "(1) slower speed as measured by the latent period between application of stimulus and appearance of end effect, this difference being greater for weak stimuli than strong; (2) . . . marked 'after discharge'; (3) less close correspondence between rhythm of stimulus and rhythm of end effect" (each reflex has its own characteristic rhythm which it maintains under any adequate stimulus); "(4) less close correspondence between the grading of intensity of the stimulus and the grading of intensity of the end effect; (5) considerable resistance to passage of a single nerve impulse, but a resistance easily forced by a succession of impulses (temporal summation); (6) irreversibility of direction instead of reversibility as in nerve trunks; (7) fatigability in contrast with the comparative unfatigability of nerve trunks; (8) much